

ENCLOSURE 2

TECHNICAL JUSTIFICATION FOR ENHANCED EVAPORATION

SOLAR EVAPORATION PONDS

The technical justification for enhancing the evaporation rate of the solar evaporation ponds using blue dye relies on the use of heat transfer terminology. To assist in understanding the explanation of how the evaporation rate will be increased, the following definitions are provided:

SOLAR HEATING - The heat received at the earth's surface from the sun.

EVAPORATION HEAT LOSS - The heat lost due to evaporation of pond water.

RADIATION HEAT LOSS - The heat radiated from the pond water to another body separated from the pond by air.

CONVECTIVE HEAT LOSS - The heat transferred within the water due to the differences in temperatures of the water itself. Density variations will result in physical movement of the water and therefore associated heat transfer.

CONDUCTIVE HEAT LOSS - The heat loss from the water to the ground or the air via the transfer of energy of motion between adjacent molecules.

REFLECTED HEAT LOSS - The amount of solar radiation which is not absorbed into the water due to, among other things, color.

The equation summarizing the relationship between these terms is:

$$\text{SOLAR HEATING} = \text{EVAPORATION HEAT LOSS} + \text{RADIATION HEAT LOSS} + \text{CONVECTIVE HEAT LOSS} + \text{CONDUCTIVE HEAT LOSS} + \text{REFLECTED HEAT LOSS}$$

Since the amount of solar heating seen at the ponds cannot be varied, any additional evaporative heat loss must result from the reduction of one or more of the other heat loss categories. The amount of heat being radiated from the ponds to another object (such as a nearby building) is essentially the same either with or without the dye. The amount of heat lost to convection will be relatively the same either with or without the dye, since the temperature gradients within the ponds will not change appreciably. A small reduction will be seen in the conductive heat loss to the liner since the dye will not allow as much solar radiation to reach the liner and will instead be absorbed by the water. Most of the benefit will result from a decrease in reflected heat loss by allowing the dark blue water to absorb additional solar radiation. Approximately six 55-gallon drums of dye will be added to the "A" solar pond and approximately two 55-gallon drums will be added to each of the three "B" solar ponds. Use of a dye is an industry accepted practice as a means of enhancing the evaporation rate of solar ponds ("Chemical Engineer's Handbook", 4th Edition, Section 17, p.15, McGraw-Hill, New York).